MULTIMEDIA EDUCATIONAL CONTENTS TO ENHANCE KNOWLEDGE

Teresa Correia[1], Hugo Ribeiro[1]

[1]University of Porto, Unit for New Technologies in Education (PORTUGAL
tcorreia@reit.up.pt, hribeiro@reit.up.pt

Abstract

This paper aims to present one of the most important services available to the teachers of University of Porto (U.PORTO): multimedia development offered by the Unit of New Technologies in Education (GATIUP). Since 2003 the U.PORTO have been aware of the growing importance of digital contents and Learning Management Systems (LMS) and initiated a pilot project aiming to implement the use of blended-learning methodology and digital contents in the classes. Implementing such a project in a traditional and large university as U.PORTO demands a great effort and dedication from all the academic community. The primary strategy was to give direct support to all teachers who were interested on new technologies for educational improvement. Among the available services were included not only the technical and pedagogical support concerning the use of LMS but also the development of educational multimedia contents as an important way to enhance students knowledge. During this "individual" work with the teachers in order to demonstrate them the advantages of using e-learning platforms one of the major concerns was to motivate them to also create digital materials. The first step was the development of screenplays about some educational topic that could be a significant multimedia learning object to be used in the online courses as a study and training tool. This paper intends to describe and shortly present some of the products made and its prominence on students learning process.

Keywords: Multimedia, knowledge, learning objects, e-learning, students.

1 INTRODUCTION

The word multimedia is used to describe a resource or application that combines two or more media. These media may be text, graphics (illustrations or photographs) video, audio, animation, simulations, and others. The advancements witnessed in the last few years in multimedia and technology has been amazing and because of this evolution, and the appearance of new educational technologies, currently one of the aims of the University of Porto (U.PORTO) is to involve all the academic community in the use of web based systems and multimedia tools to enhance teaching and learning. This goal should be achieved through the Unit for New Technologies in Education (GATIUP).

2 DEVELOPMENT OF MULTIMEDIA CONTENTS AT THE UNIVERSITY

2.1 New Technologies in Education

GATIUP is formed by a multidisciplinary group of eight persons with different educational backgrounds. The main activity is to give a direct support, technical and pedagogical, to all teachers as a way to enable and encourage initiatives of open and distance learning. However, the office has several roles and offers to their academic community different services:

- Pedagogical and technical support to all the teachers that wish to combine an online component with classical lectures (blended-learning);
- Administration of University e-learning platform (Moodle),
- Technical support to online assessment;
- Design and development of multimedia contents;
- Training on educational technologies and online methodologies;
- Videoconference, telepresence and streaming;

- European projects participation;
- Promotion or participation in events related to new technologies for educational use.

In the last years the number of courses using blended-learning is growing and on the actual educational scenario, where technological change is increasing and is required for teachers to "adopt" new methodologies of teaching and learning, GATIUP wish to emphasize multimedia learning objects as a tool to improve and enhance students knowledge. For that purpose the office offers to their teachers a multimedia development service free of charge.

2.2 The process of multimedia development service

The multimedia development undertaken by GATIUP is provided by a small sub-group of four persons, one dedicated only to video contents and the others produce different types of resources. The most common types of multimedia contents produced at the University are video, animation, simulation, and graphics.

As the online component in courses from U.PORTO become regular, it has been observed in teachers a greater interest in "refreshing" the learning contents available and multimedia is now seen as a new type of learning resource that can allow more autonomy, training, and self-assessment by students. However, although the purpose of GATIUP is to motivate and increase the number of teachers using multimedia contents, due to the low number of people working in this area at the office it was necessary to establish a procedure for this development service.

The procedure starts with the way the request for development is carried out. The teachers need to fill a form available at U.PORTO e-learning website (http://elearning.up.pt). On this form is asked to specify the type of content (video, animation, simulation, graphics or other), the purpose (what will be the use of the product) and, most important, its relevance (the added value of this product for teaching and learning). Then the form is automatically forwarded to the office and, upon receipt, the element of multimedia service responsible for the management of requests, together with the coordinator's office, assesses whether it is liable to the team to produce it. For this evaluation are taken into account such aspects as (1) the teaching purpose and relevance described, (2) reusability, (3) available personal, (4) and expertise of the team.

When the request is accepted it will be allocated normally to one element of development team, but the number of developers involved depends on the type of content and workload. After this the most complex part of the process starts, and it is when those who create the idea - the teachers - and those who will apply the idea to a multimedia format - the developers – will define all the concept of the product. To facilitate this process, which over the years was often difficult given the different vision and working methods of each side, it was necessary to define certain phases of work.

The 1st phase is the planning and data collection. The developer meets with the teacher to define the subject, target group, and learning objectives of the product and to plan the tasks. After the concept is defined it goes to the 2nd stage, construction of a script or storyboard the key element of nearly all multimedia content development. At this time scenarios and all elements should be defined. In the 3rd phase all the elements needed to develop the final product are created (photographs, drawings, sounds, videos and others). The 4th stage is then made by assembling all the elements, the multimedia content development. Once ready the content it is sent for review, the necessary changes are made and the product is finalized.

Not all the contents produced can follow these steps, however the team always try to define a work plan with the teacher as a manner to accomplish a better product. Regardless the type of content to be created, there is something common to all of them: the communication between developer and teacher is continuous throughout the development.

The copyright of the contents produced by GATIUP belong to the University, yet since the scientific coordination is entirely made by teachers the contents are not published or used without knowledge and approval of both parties.

Some of the multimedia contents developed in recent years, which we consider to be of strong relevance to the educational process of teaching and learning, obtained from the academic community (teachers and students) a positive acceptance. For that reason we decided to present here some examples of what we considered a good practice in the use of multimedia learning objects as a tool of self-training and development of knowledge.

3 MULTIMEDIA CONTENTS: THREE LEARNING SCENARIOS

3.1 Basic Immunology game

Basic Immunology is a course that belongs to the medical education of dentistry and medical students. It can be defined as the study of the cells and molecules involved in host defence mechanisms and disease processes. The main goal is to provide knowledge on how the immune system reacts, how the body defends itself against diseases and what can happen when the system fail and the patient have serious complications. The classes are composed by one hour lectures twice a week and 90 minutes seminaries every other week. The student's final grade is based upon final examination score (graded in a numeric scale from 0 to 20) and adjusted according with their performance in seminars, lectures, and online quizzes.

In 2008 the teachers of Immunology course, from the Faculty of Medicine, came up to GATIUP with a multimedia content proposal. Based on a work propose to the class in the academic year of 2007/2008, the teachers wanted to recreate in a digital support some of the games designed by the students about some course learning contents. The intention was to develop a web-based knowledge games on immunology contents for third-year medical students and compare the performance of students that had contact with the games with students that only had access to the classical lectures. The relevance of this request was that the games would be used as a training tool on the online course.

Between 2008 and 2009 the office developed three games according to students storyboard. This is the first of all three and was named "Who wants to B a lymphocyte?" having in mind the original board game by *Eckert GU et al. Med Teach. 2004 Sep; 26(6):521-524*. The game was designed to enhance student knowledge in the field of B cell development, activation, and differentiation.

The game was developed in Adobe Flash 8 and consists in a simulation of a board game, which is played with a virtual dice and "B cell-pawns" by as much as 3 players (Fig. 1).

Fig. 1 - Starting game screen and players selection.

The game board contains 55 squares and 16 of them – the green squares - have question marks (Fig. 2) that determines whether the player advances, retreats or stays in that place. The players roll the dice moving their pawn according to the number rolled. Whenever a player lands on a green square has to provide the correct answer for two questions in 30 seconds each (Fig. 3). The questions are sort randomly from a database of 80 questions elaborated by the students and revised by teachers. The goal is to reach first the square 55.

Fig. 2 - Game board with players in action.

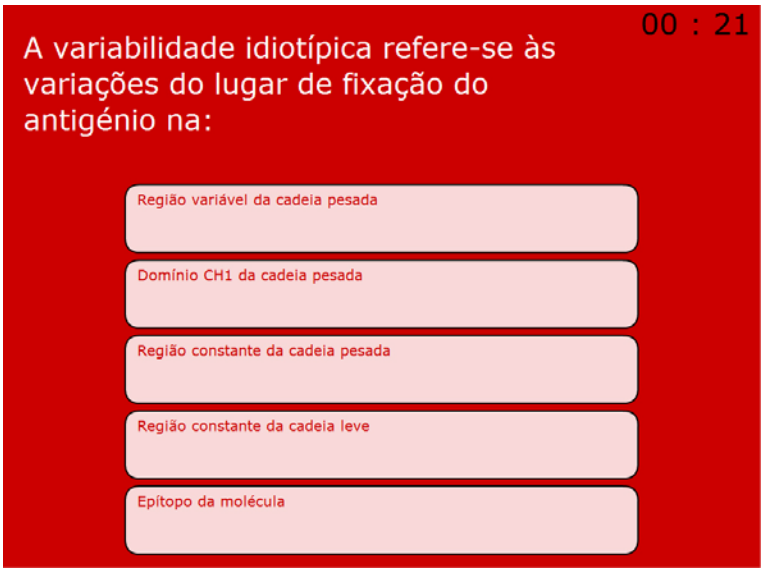

Fig. 3 - Game questions page with time counter on top.

When the game was finished the teachers decided to evaluate is influence on students learning and approval. So, in the academic year of 2008/2009, it was tested with the students on face-to-face classes. Students were randomly allocated into game (GG) and lecture (LG) groups. The LG consisted of an exposition of 60 minutes of the ontogeny, differentiation, and activation of B cells. The GG played for 45 minutes. During the lecture students were able to discuss the subjects, while in the game the teachers did not intervene. An evaluating quiz with 28 questions was administered before and after the experiment. The changes in scores within groups were compared by teachers using paired t-test and the differences between LG and GG were compared by analysis of covariance with baseline value as covariate.

A significant improvement in number of correct answers of the quiz was observed after the lecture and the game in both groups, however the mean increase was higher in the LG ($p=0.003$; mean change LG: 5.29 [95% CI, 3.57 to 7.00], $p<0.001$ vs. GG: 1.81 [95%CI, 0.70 to 2.93], $p=0.005$). A non-significant decrease in the number of wrong answers was observed in both groups with no differences between them.

Table 1 - Changes in test scores in lecture (LG) and game (GG) student groups. Data are presented as mean (± sd) unless otherwise indicated.

Score	Lecture Group, n=14			Game Group, n=11			LG *vs* GG
	Before	After	Change	Before	After	Change	p-value
Correct	7.6 (2.92)	12.9 (3.40)	5.29 (3.57 to 7.00); p<0.001	8.6 (2.50)	11.5 (3.53)	1.81 (0.70 to 2.93); p=0.005	0.003
Wrong	12.3 (4.60)	10.5 (3.50)	-1.78 (-4.77 to 1.20); p=0.219	11.0 (5.20)	10.4 (2.01)	0.45 (-1.91 to 2.82); p=0.679	0.303
Final	-4.7 (2.98)	2.43 (6.30)	7.07 (3.25 to 10.89); p=0.002	-2.5 (4.00)	-1.09 (3.67)	1.36 (-0.96 to 3.69); p=0.222	0.056

Even though the differences between both methods were not significant the importance of a study tools like this was revealed.

3.2 Clinical Anatomy virtual quiz

One of the major multimedia developments made was “Virtual Quiz” for the course of Clinical Anatomy and certainly the one that involved smaller pieces.

Clinical Anatomy is a base course for future physicians as it allows to integrate basic anatomical knowledge to clinical activity developed by health professionals [4]. This course should give medicine students solid and strong anatomical background so that they can meet the emerging challenges of clinical practice. This course appears on the second year of the medical curricula precisely to ensure students get the fundamental anatomic knowledge, essential to the physical examination of patients, diseases’ diagnosis and some clinical procedures [4].

This tool was a next step after the not so interactive contents used on the Learning Management System (LMS), until 2008 used more as a repository. This new approach aimed to mimic the anatomical quiz that caused high levels of stress on the students. Besides there was a logistical difficulty allowing training for this kind of assessment.

So this animation was built in Adobe Flash 8 and includes, randomly, 40 images of a total of 2700. To each one of this image (or labeled structure) there is a correct answer – in fact it can also be more than one, because, sometimes, there’s various ways of naming a structure. The user has a minute to answer each set of two images (Fig. 4). After the time has expired a sound is heard – quite similar to the one students hear during their on-site practical examination – and the page advances automatically to the following set of images. After viewing and identifying the 40 anatomical structures the grade is shown and the student can check his answers and compare them with the correct ones - immediate feedback (Fig. 5).

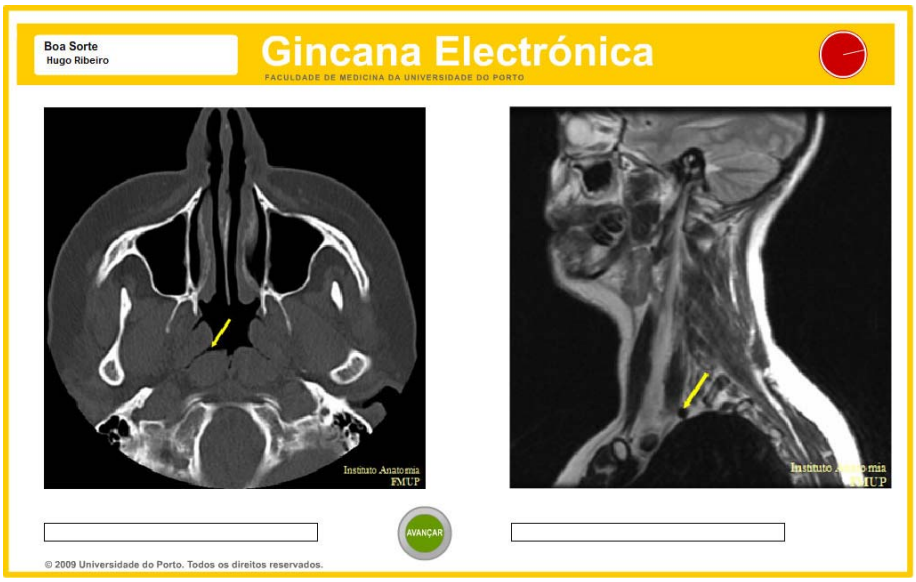

Fig. 4 - “Virtual Quiz” interface showing two structures to identify, and time counter on top.

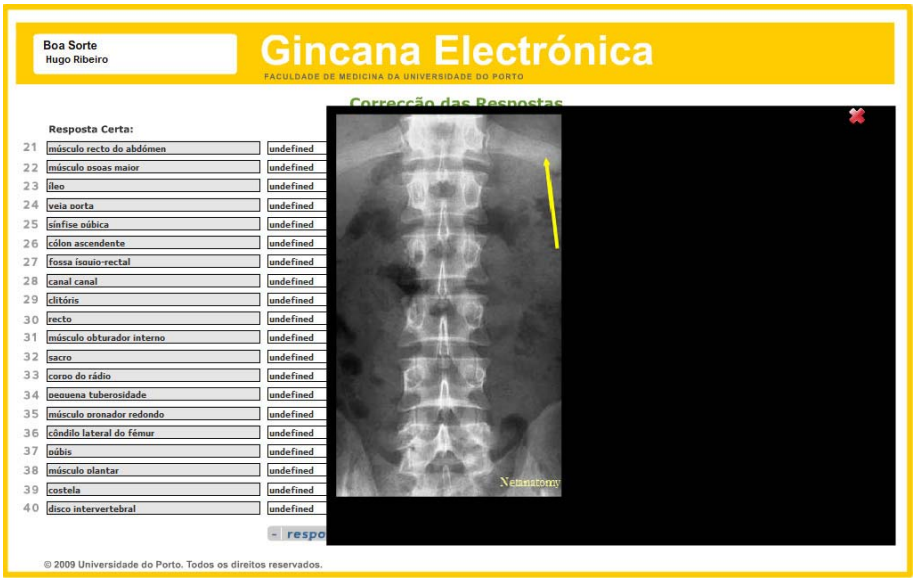

Fig. 5 - “Virtual Quiz” students answers and revision.

This tool was exported to a SCORM package allowing importing the final grade into the LMS so that teachers can access to individualized information. Aiming great versatility it is also possible to add images, types of imaging and structures as well dividing it into several other small quizzes.

In the 2007/2008 school year the LMS was visited by 272 students from 304 registered. The “Virtual Quiz” was performed at least once by 73.2% of the identified users.

A correlation between the number of sessions – logged in – and classification obtained in the practical assessment, the real on-site quiz, was verified. Students that had performed the “Virtual Quiz” achieved a higher grade than the ones who didn’t (14,7 vs 13,9 p=0,040) [3].

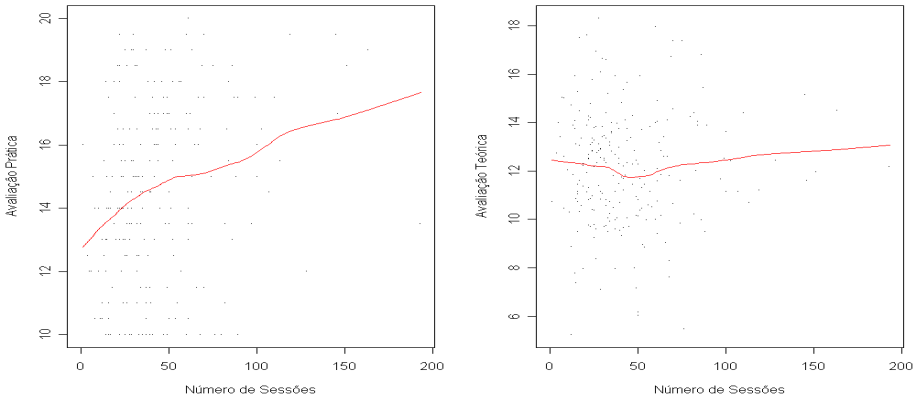

Fig. 4 - Number of sessions and grading of the practical (left) and theoretical exam (right)

Besides grade results and analysis it is important to emphasize the students' positive remarks concerning the tool, specially because of its immediate feedback ability. Also is important to note that this tool allowed a great simplification of process allowing an increased number of students to practice anatomical identification, witch, as we stated, logistically, it's not easy.

4 CONCLUSIONS

From feedback obtained from teachers and students it is now clear the importance of developing new study tools. The intention of GATIUP is spread educational multimedia contents, not only as a creative and appealing tool, but essentially as a tool that when used autonomously and regularly by students can improve their knowledge on complex learning issues. Even though the use of multimedia contents has been significant and has become increasingly common in many areas of education, nobody can deny that traditional face-to-face classes with lecture methods still necessary in the majority of the courses.

Despite the opportunities multimedia contents provided, it is important to question facts like costs, human resources needs, and the real impact they have in students learning journey. A real and effective trace of outcomes should be done for all multimedia contents, if possible, comparing students with different methodologies. These two examples followed this method but we are aware it's not possible to use it always.

So, if one of the main goals of GATIUP is to increase the number of teachers using multimedia contents in their courses offering them a service of development, on the other hand the office is aware and will not produce contents without clear learning objectives and without a reusable perspective.

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